

PULSE OXIMETRY TESTING FOR CRITICAL CONGENITAL HEART DISEASE IN NEWBORNS

Kentucky Newborn Screening Program



Kentucky Public Health

Prevent. Promote. Protect.

KY NEWBORN SCREENING PROGRAM:

THE FOUNDATION OF THE PROGRAM



KENTUCKY NEWBORN SCREENING STATUTE AND REGULATION KRS 214.155 & 902 KAR 4:030

Hospital administrators, birthing facilities and medical personnel caring for newborns ages 28 days or less are required by law to assure that every infant in their care receives the newborn screening test.



- Any parent or caregiver that refuses the newborn screening test **must** sign the provider's standard Refusal of Care form.
- A copy of the signed refusal form **must** be faxed to the Kentucky Newborn Screening Program within 7 days.



KENTUCKY'S NEWBORN SCREENING PANEL

- The United States Health and Human Services (HHS) Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (SACHDNC) recommends that all states screen for 31 core conditions.
- Kentucky currently screens for 48 inborn errors of metabolism and genetic conditions on the blood-spot panel.



- The addition of Pulse Oximetry Testing for Critical Congenital Heart Disease (CCHD) will be fully implemented in 2013.
- The Hearing Screen is administered through the KY Commission for Children with Special Health Care Needs.
- In total, 49 disorders and conditions will be performed as Kentucky's newborn screening panel.



**ABOUT
PULSE
OXIMETRY
SCREENING
FOR
CRITICAL
CONGENITAL
HEART
DISEASE**



NATIONALLY RECOMMENDED

The addition of Pulse Oximetry Screening for Critical Congenital Heart Disease (CCHD) is endorsed by:

- United States Health and Human Services (HHS) Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (SACHDNC);
- American Heart Association;
- American Academy of Pediatrics;
- American College of Cardiology;
- American College of Medical Genetics; and
- March of Dimes



Kentucky Public Health
Prevent. Promote. Protect.

WHY IS THIS SCREENING IMPORTANT?



Kentucky Public Health
Prevent. Promote. Protect.



American
Heart
Association®

congenital heart disease is the #1
killer of infants with birth defects.
— you can help



CONGENITAL HEART DISEASE

- The most common of all birth defects.
- Affects 1 in every 100 babies in the U.S. each year.
- Accounts for nearly 30% of all infant deaths due to birth defects.



CRITICAL CONGENITAL HEART DISEASE

- 17-33% of Congenital Heart Disease is actually CRITICAL Congenital Heart Disease (CCHD).
- CCHD can often be identified by prenatal ultrasound; however
- 50% of all infants with CCHD are discovered *after* the infant is discharged from the hospital.



- Unfortunately, a seemingly normal, healthy infant can suddenly experience serious or life-threatening complications within the first few days or weeks of life that requires emergency care.
- According to a recent California study, the median age of death due to undiagnosed CCHD is less than 2 weeks of age.



TEN FINGERS, TEN TOES, HEALTHY HEART?



**SHOULDN'T
YOU KNOW IF
YOUR BABY'S
HEART IS
OKAY
BEFORE
LEAVING THE
HOSPITAL?**

Learn more about pulse oximetry screening.
BabyHeartScreening.com

HOW CAN PULSE OXIMETRY TESTING HELP?

- Detection of CCHD increases to about 85% *before* hospital discharge with the use of Pulse Oximetry as part of an infant's routine newborn screen.
- With the use of Pulse Oximetry, CCHD benefits from early detection and interventions such as:
 - Surgery;
 - Heart Catheterization;
 - Medication



THE SEVEN TARGET CCHD LESIONS

- Hypoplastic Left Heart Syndrome (HLHS);
- Tricuspid atresia;
- Pulmonary atresia;
- Tetralogy of Fallot (TOF);
- Total anomalous pulmonary venous return (TAPVR);
- Transposition of the Great Arteries (TGA); and
- Truncus Arteriosus



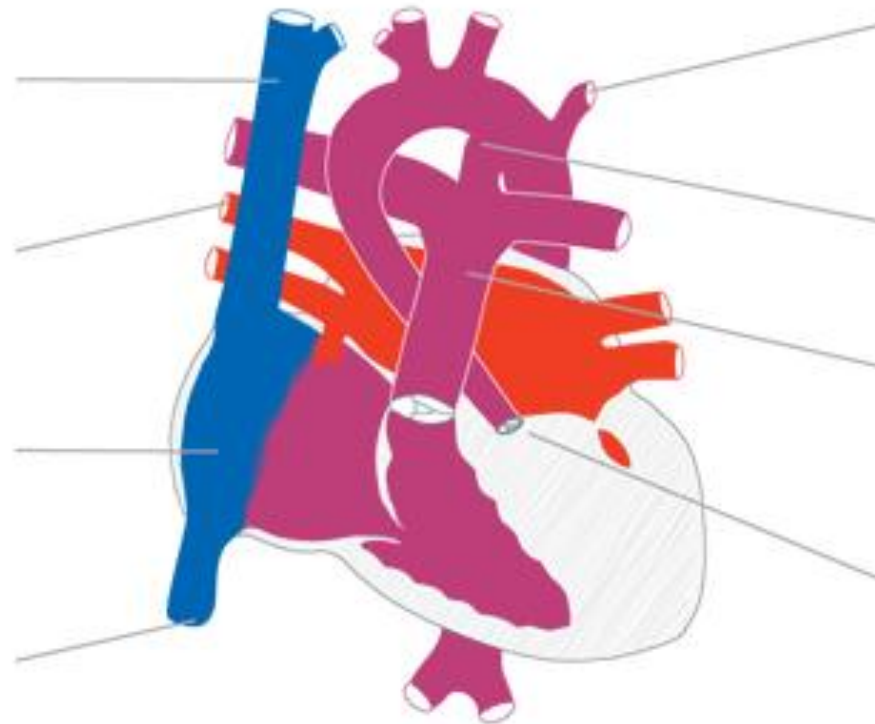
HYPOPLASTIC LEFT HEART SYNDROME (HLHS)

Blue blood coming back to heart from head and upper body (SVC)

Red blood coming back to heart from lungs (PV)

Red blood being pumped through hole to mix with blue blood on right side of heart

Blue blood coming back to heart from lower body (IVC)



Blue and red blood being pumped to all parts of the body instead of just red (Aorta)

Duct (PDA)

Red and blue blood being pumped to lungs instead of just blue (PA)

Usually no blood pumped from LV to aorta

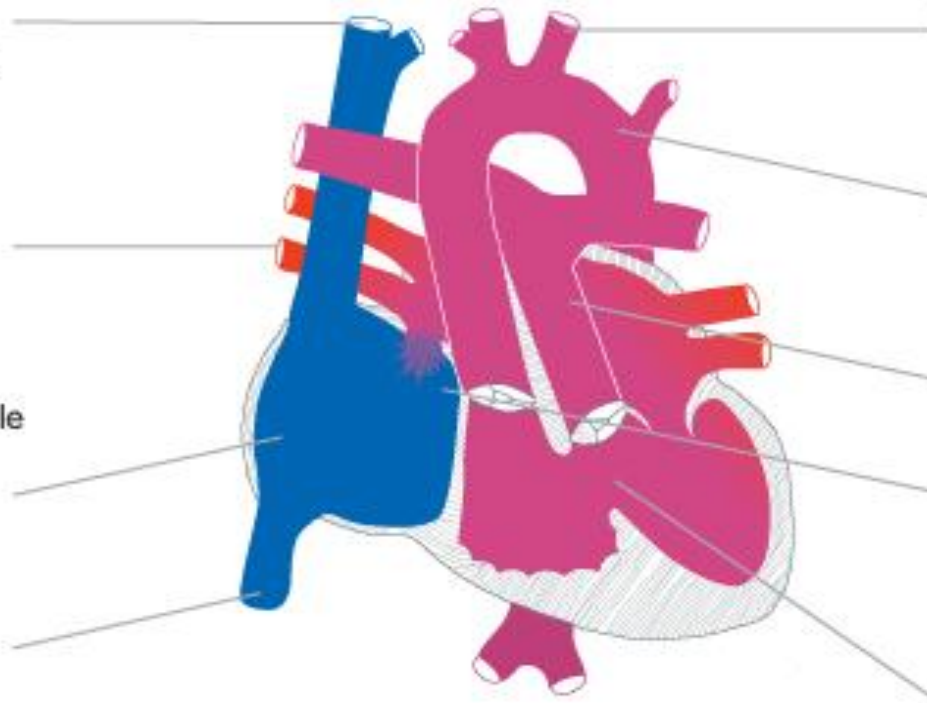
TRICUSPID ATRESIA

Blue blood coming back to heart from head and upper body (SVC)

Red blood coming back to heart from lungs (PV)

Blue blood unable to get into right ventricle because tricuspid valve is blocked or missing

Blue blood coming back to heart from lower body (IVC)



Blue and red blood being pumped to all parts of the body instead of just red (Aorta)

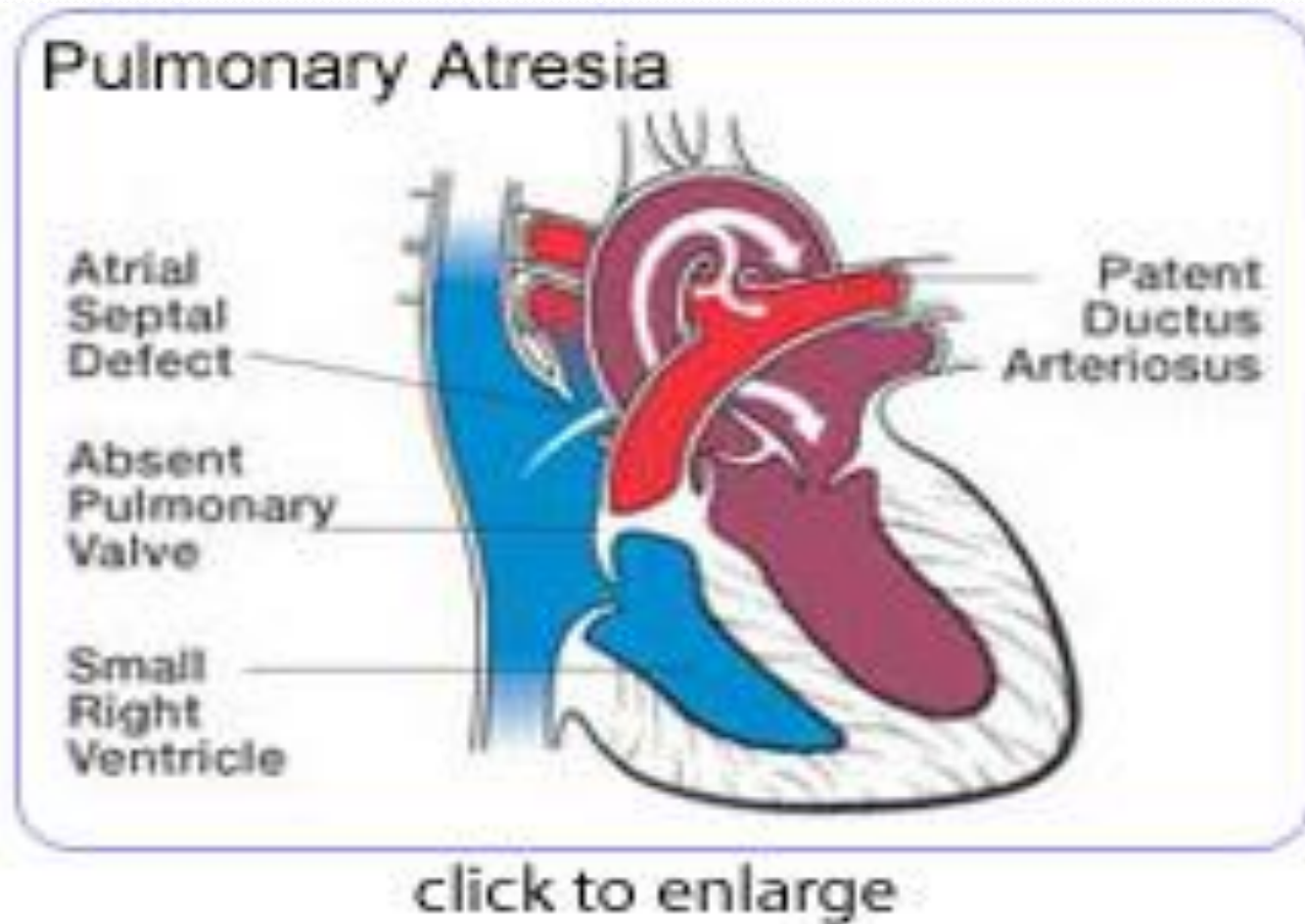
Red and blue blood being pumped to lungs instead of just blue

Pulmonary artery (PA) may be blocked

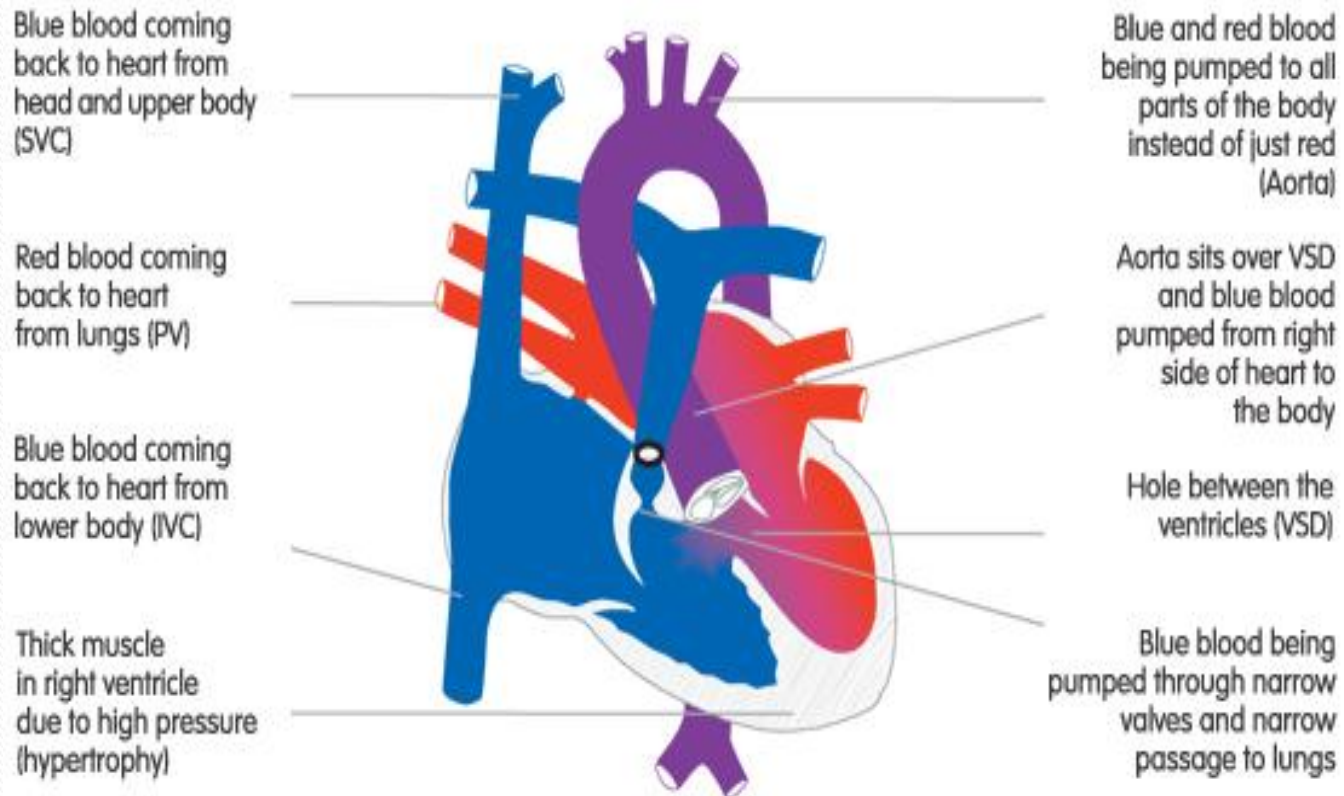
Blue blood flows through hole in heart to left side, and mixes with red blood (ASD)

Some children have a hole between the two pumping chambers

PULMONARY ATRESIA

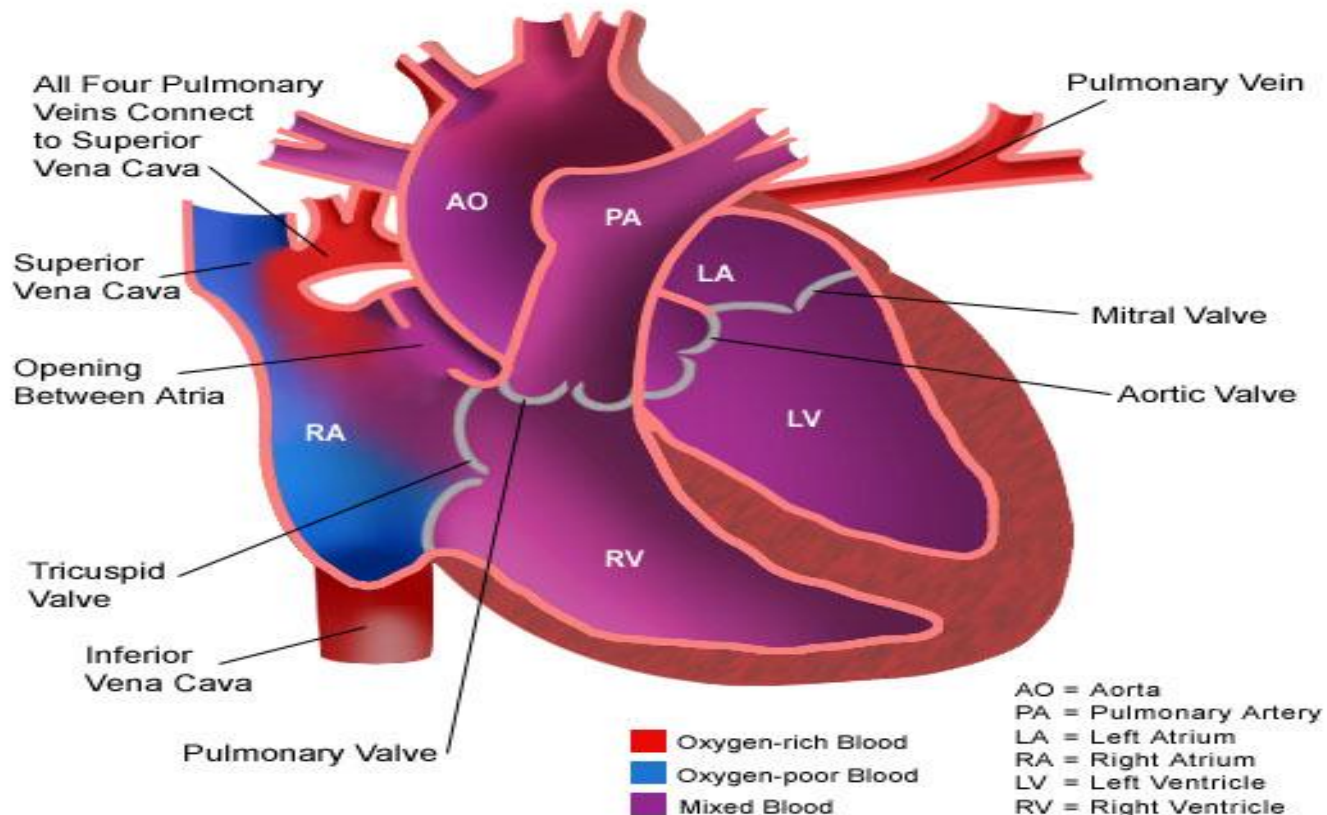


TETRALOGY OF FALLOT



TOTAL ANOMALOUS PULMONARY VENOUS RETURN (TAPVR)

Total Anomalous Pulmonary Venous Return



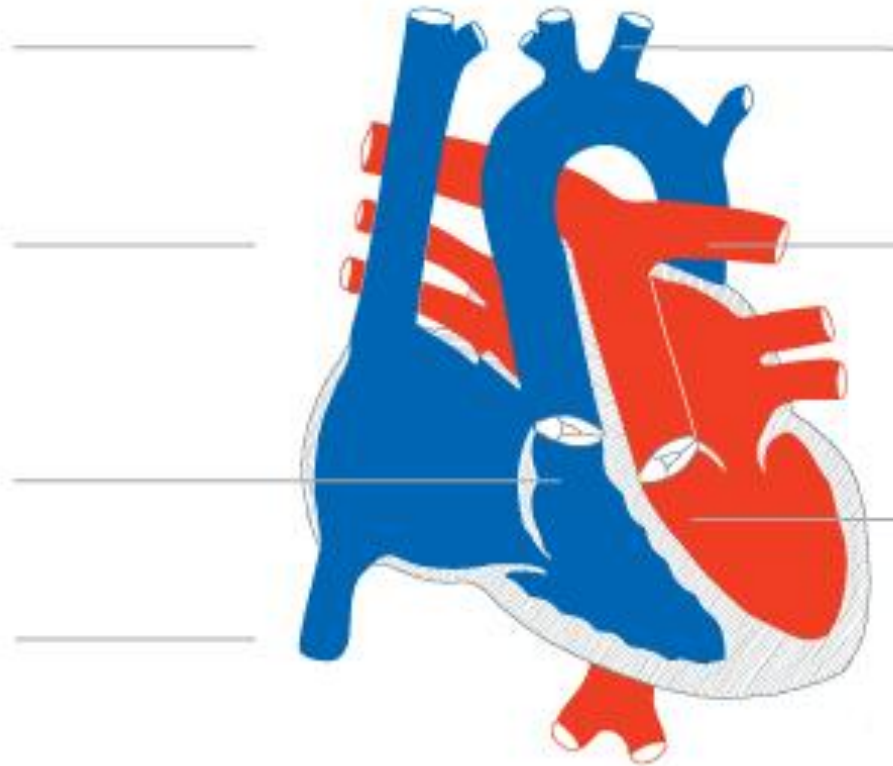
TRANSPOSITION OF THE GREAT ARTERIES (TGA)

Blue blood coming back to heart from head and upper body (SVC)

Red blood coming back to heart from lungs (PV)

Blue blood pumped from right ventricle into aorta instead of pulmonary artery

Blue blood coming back to heart from lower body (IVC)



Blue blood being pumped to all parts of the body instead of just red (Aorta)

Red, oxygenated blood pumped to lungs instead of blue, deoxygenated blood (PA)

Red blood pumped from left ventricle into pulmonary artery instead of aorta

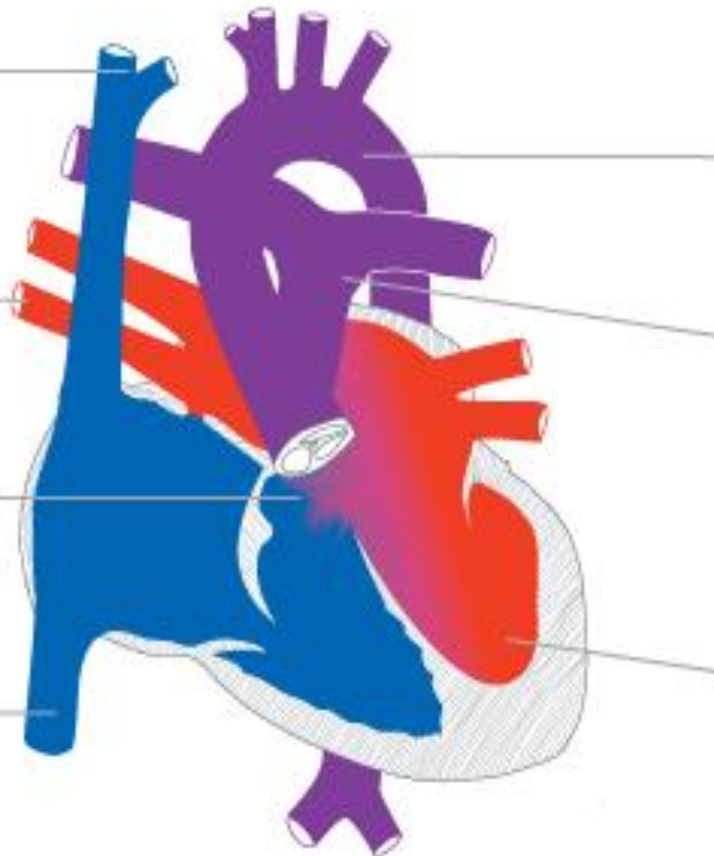
TRUNCUS ARTERIOSUS

Blue blood coming
back to heart from
head and upper body
(SVC)

Red blood coming
back to heart
from lungs (PV)

Blue blood crosses
hole and mixes
with red blood (VSD)

Blue blood coming
back to heart from
lower body (IVC)



Blue and red blood
being pumped to all
parts of the body
instead of just red
(Aorta)

Red and blue blood
being pumped to
lungs at high pressure
instead of just blue
(PA)

Blue and red blood
pumped into one
artery

WHO SHOULD BE SCREENED?

- Newborns who are 24-48 hours of age. The closer to 48 hours, the better.
- If an early discharge is planned, pulse oximetry screening should be performed as late as possible before hospital discharge.
- Infants in neonatal intensive care units should be screened at 24-48 hours of age or *when medically appropriate* after 24 hours of age.





OVERVIEW

Pulse oximetry:

- Measures the oxygen saturation of the blood;
- Is non-invasive and painless;
- Is accurate and reliable;
- Is fast and easy to perform; and
- Is inexpensive.



- Pulse Oximetry testing should always be used as a compliment to the physical examination and should *never* be used as a replacement.
- Contrary to the rest of the newborn screening panel, interpretation of pulse oximetry test results and decisions regarding intervention will take place at the hospitals and birthing facilities at the actual time the test is performed.





EQUIPMENT

- Each birthing facility will be responsible for selecting and securing pulse oximetry equipment for screening newborns for CCHD, if appropriate equipment is not already available.
- Pulse oximetry equipment must be compliant with national standards:
 - Cleared by the FDA for use in newborns;
 - Calibrated regularly based on manufacturer guidelines.



TIPS ON PROPER SCREENING

- Conduct the screening in a quiet area.
- Do not attempt to perform pulse oximetry on an infant while the baby is crying or if the baby is cold.
- If possible, conduct screening while the infant is awake and calm.
- Make sure the infant's right hand and both feet are clean and dry. Substances, such as dried blood, can affect the pulse ox reading.



PULSE OX PROBE PLACEMENT

- Choose the proper application site on the outside, fleshy part of the infant's hand or foot.



- Place the light emitter portion of the probe on the top of the hand or foot.
- Place the photodetector directly opposite of the light emitter, on the bottom of the hand or foot.
- **REMEMBER**: The photodetector and the light emitter must be directly opposite each other in order to obtain an accurate reading.
- Secure the probe to the infant's hand or foot using the adhesive or foam tape recommended by the supplier.



PROPER ALIGNMENT

Application with
Disposable Probe



“Star to the Sky”

Application with
Reusable Probe



“Raise the (Red) Bar”

PULSE OXIMETRY

NEWBORN
SCREENING
PROTOCOL
FOR CCHD



WHEN TO IMPLEMENT PULSE OXIMETRY PROTOCOL



PULSE OXIMETRY SCREENING PROTOCOL FOR ASYMPTOMATIC NEWBORNS FOR CRITICAL CONGENITAL HEART DISEASE

CHECK PULSE OXIMETRY AT 24-48 HOURS OF LIFE

OR

**SHORTLY BEFORE DISCHARGE IF <24 HOURS OF
AGE**

OR

**WHEN MEDICALLY APPROPRIATE BEFORE
DISCHARGE IF IN NICU.**

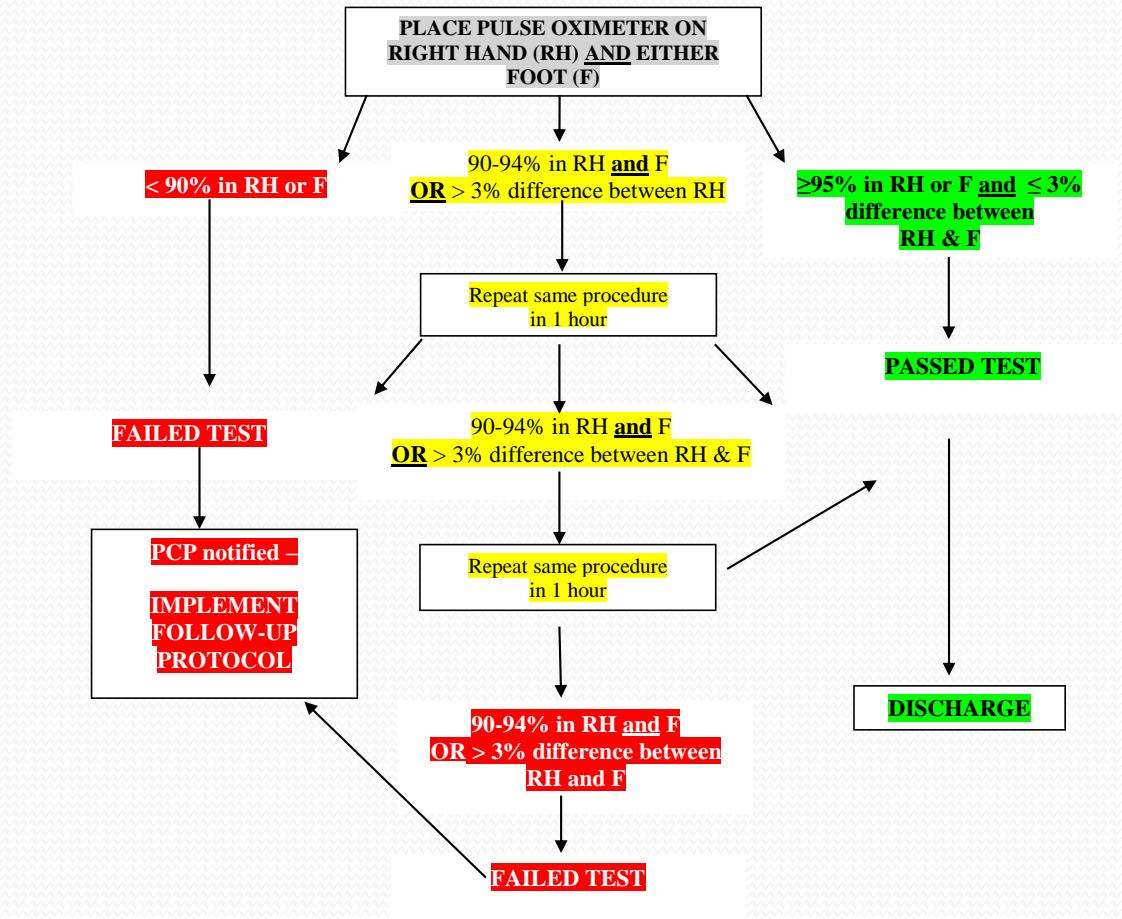
ROOM AIR ONLY



CCHD Screening Protocol

Pulse Oximetry Screening Protocol for Asymptomatic Newborns for Critical Congenital Heart Disease

**CHECK PULSE OXIMETRY AT 24-48 HOURS OF LIFE
OR SHORTLY BEFORE DISCHARGE IF <24 HOURS OF AGE – ROOM AIR ONLY**



If the Initial Pulse Ox reading is Abnormal:

- 90 – 94% in RH and foot

OR

- $> 3\%$ between the RH and foot

REPEAT PULSE OX IN ONE HOUR



If the Second Pulse Ox reading is:

- 90 – 94% in RH and foot

OR

- > 3% between the RH and foot

REPEAT PULSE OX IN ONE HOUR



If the Third Pulse Ox reading is:

- 90 – 94% in RH and foot

OR

- $> 3\%$ between the RH and foot

**CONSULT THE PCP TO IMPLEMENT
FOLLOW-UP PROTOCOL.**



FAILED SCREEN AND FOLLOW-UP PROTOCOL

- PCP is notified;
- PCP orders Pediatric Echocardiogram;
- Pediatric Echocardiogram must be performed by a trained pediatric sonographer;
- PCP consults pediatric cardiologist (UK, UL, etc.);
- Pediatric Cardiologist will determine further diagnostic follow-up.
- Hospital staff confirms that CCHD Data Collection Form has been faxed to us at 502-564-1510.





Data Entry – CCHD Results

KY-CHILD

- Same system as data entry for the newborn screen.
- New CCHD tab
- Should be completed by staff that performs other KY-CHILD and newborn screening data entry



CCHD SCREENING INFORMATION – INITIAL SCREEN

- MR #: **999999**
- Patient Name: **TEST**
- Birthing Facility: **HOSPITAL NAME**
- Date of Birth: **08/14/2012**
- Time of Birth: **1000**
- Gestational Age at Birth: **36** weeks
-
- *Date of Screening: _____ (mm/dd/yyyy) *Time of Screening(24-hour): _____
- *Age at Screening: (click Calculate Age Button)
- *Pulse OX Saturation of Right Hand(RH): _____ %
- *Pulse OX Saturation of Foot: _____ %
- Difference in Oxygen Saturation(RH and Foot): _____ %
- *Performed By: _____
- Pass ___ Fail ___ N/A ___
- If 'Fail' is checked, there will be 2 boxes that appear at the bottom of the screen:
"Refer Immediately" or "Second Screen Required in 1 hour"



SECOND SCREEN

- Information from previous screen is re-populated.
- Data fields are the same as initial screen.

If second screen is a “**PASS**”:

- Third screen is not required and
- No further action is necessary.

If second screen is a “**FAIL**”:

- Perform third screen in 1 hour.



THIRD SCREEN

- Information from previous screen is re-populated.
- Data fields are the same as initial screen.

If third screen is a “**PASS**”:

- No further action is necessary.

If third screen is a “**FAIL**”,

- **IMPLEMENT THE FAILED SCREEN FOLLOW-UP PROTOCOL:**



ANOTHER REVIEW OF FAILED SCREEN FOLLOW-UP PROTOCOL

- PCP is notified;
- PCP orders Pediatric Echocardiogram;
- Pediatric Echocardiogram must be performed by a trained pediatric sonographer;
- PCP consults pediatric cardiologist (UK, UL, etc.);
- Pediatric Cardiologist will determine further diagnostic follow-up.
- If the pediatric echocardiogram and clinical assessment indicates other conditions that may affect pulse oximetry (i.e., pulmonary disorders), consult a neonatologist.
- Hospital staff confirms that CCHD Data Collection Form has been faxed to us IMMEDIATELY at 502-564-1510.



SCREEN N/A

When a Pulse Ox screen is not performed due to:

- Prenatal Diagnosis of Congenital Heart Disease
- Transferred to another facility
- Or if there is another reason, click “Other” and a text box will appear to specify the circumstances



THE ROLE OF THE NEWBORN SCREENING FOLLOW-UP PROGRAM

- Once the data collection form is generated from KY-CHILD and faxed to us, we will monitor the infant's status until the final diagnosis is made.
- We will perform QA to ensure that every baby born in KY receives the pulse ox screening prior to hospital discharge.
- If the infant did not receive the screen, we will contact the hospital to arrange the test be performed ASAP.



Kentucky's Newborns

**THEIR
FUTURE'S
SO BRIGHT
– THEY
GOTTA
WEAR
SHADES!**



CONTACT INFORMATION

- If you have questions or problems regarding input into KY-CHILD

**Please contact your state KY-CHILD representative,
Carol Zeigler at (502) 564-0105 ext. 2638**

- If you have any questions for program staff, please contact the

KY Newborn Screening Follow-up Program

(502) 564-3756 ext. 4367 (phone)

(502) 564-1510 (fax)

